NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

FOREST STAND IMPROVEMENT

(ACRE)

CODE 666

DEFINITION

The manipulation of species composition, stand structure, and stocking by cutting or killing selected trees and understory vegetation.

PURPOSES

- To increase the quantity and quality of forest products, e.g., sawtimber, veneer, wood fiber, poles, pilings, maple syrup, naval stores, nuts and fruits.
- To harvest forest products.
- To initiate forest stand regeneration.
- To reduce the potential of damage from wildfire, pests, and moisture stress.
- To restore natural plant communities.
- To achieve a desired understory plant community.
- To improve aesthetic, recreation, and open space values.
- To improve wildlife habitat.
- To improve water conservation and yield.
- To achieve a desired level of crop tree stocking and density
- To increase carbon storage in selected crop trees.

CONDITIONS WHERE PRACTICE APPLIES

All forest land where improvement of forest resources is needed.

CRITERIA

General Criteria Applicable to All Purposes

The harvest-regeneration strategy will be identified for all planned forest improvement harvesting:

- Uneven-aged management systems (single-tree selection, group selection, coppice selection)
- Even-aged management (clear-cut, seed-tree, shelterwood, coppice)

The extent or size of treatment area shall achieve the intended purpose.

Preferred tree and understory species are identified and retained to achieve all planned purposes.

Spacing, density, size class, number, and amounts of trees and understory species to be retained will follow established guidelines for the intended purposes.

Stocking guidelines shall contain stocking in terms of basal area, spacing or trees per acre by species and size class distribution.

The method, felling direction and timing of tree cutting for harvesting shall facilitate efficient and safe tree removal and protect sensitive areas such as vernal pools, riparian zones, cultural resources, and structures.

Forest stand improvement activities shall be performed to minimize soil erosion, compaction, rutting, damage to remaining vegetation, and hydrologic conditions.

Minimize hydrologic alterations and damage to remaining vegetation.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service. Contact Sally Butler, NRCS IRT Forester at 207-990-9557 or email comments and concerns to sally.butler@me.usda.gov

Slash and debris left on the site after treatment will not present an unacceptable fire, safety, environmental, or pest hazard. Such remaining material will not interfere with the intended purpose or other management activities.

Comply with applicable federal, state and local laws and regulations during the installation, operation and maintenance of this practice, including the state's Best Management Practices (BMPs) and Pesticide application regulations.

CONSIDERATIONS

Silvicultural objectives and harvest-regeneration strategies may change over time and may be limited by prior management.

Successful regeneration of desirable species is usually dependent upon timely application of forest stand improvement and other practices, e.g., prescribed burning, site preparation, tree and shrub establishment, prescribed grazing, and use exclusion.

Adjust the extent, timing, size of treatment area, or the intensity of the practice to minimize cumulative effects (on-site and off-site), e.g., hydrologic and stream alteration, habitat fragmentation, nutrient cycling, biodiversity, visual resources. Where visual qualities are important, retain trees of unusual form, brilliant autumn color or attractive bark, flowers or fruit.

Assess potential landowner and operator liability before forest stand improvement activities begin.

Time the practice to least disturb seasonal wildlife activities. Wildlife food and cover can be retained by minimal modifications to composition and spacing.

Retention of selected dead and dying trees, including down material, will enhance wildlife habitat values.

Where possible, retain a minimum of 3 actively used den trees or 3 large hardwood cull trees, and a minimum of 5 mast-producing trees such as oak, hickory, and beech on each acre treated. Cull trees are not counted as part of the basal area (Table 1) left after thinning: mast trees and den trees with timber value are counted as residual basal area after thinning. Also consider releasing apple trees for wildlife.

Landowners should secure a written contract with any service provider that specifically describes the extent of activity, duration of activity, responsibilities of each party and amount and timing of payments for services provided.

Consider environmental concerns such as threatened and endangered species and natural areas.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, narrative statements in the conservation plan, or other acceptable documentation. Separate specifications for weeding, releasing and thinning are provided.

OPERATION AND MAINTENANCE

Periodic inspections during treatment activities are necessary to ensure that objectives are achieved and resource damage is minimized. Follow-up and ongoing management activities will be needed to obtain desired results.

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CONSERVATION PRACTICE SPECIFICATIONS

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WEEDING

- The purpose is to remove unwanted species and favor desirable species.
- Weeding is usually needed the most in mixed stands of conifers and hardwoods, when conifers are the crop trees.
- When weeding a mixed stand, work toward small groups or patches of pure hardwoods or conifers.
- Used with seedlings and saplings 1" to 4" in diameter and approximately 10 to 15 feet in height. (Conifers may need weeding sooner)
- Stand is between 5 and 20 years of age.
- Minimum stocking for hardwood stands is 200 well-distributed, vigorous seedlings or saplings per acre with an average spacing of 17 feet between selected crop trees. 1/ 2/
- For adequately stocked and spaced softwood stands overtopped by hardwoods, chemically or mechanically release a minimum of 150- 200 crop trees per acre.
- In White Pine plantations and fully stocked natural stands, delay release until trees are a minimum height of 20 feet. Once released, White Pine does not need thinning until the stand averages 7-8" DBH.
- Other species of softwood may be thinned as soon as the crowns have closed.
- Minimum stocking for White Pine and Red Pine is 350 well-distributed, vigorous pine seedlings or saplings per acre. 3/

  On soils with hardwood site indices of 60 or greater, manage as mixed stands favoring groups of pine. Nearly pure stands of pine should be developed where possible on soils with lower hardwood site indices, especially on sandy or gravelly outwash soils or where hardwood site indices are less than 50.

  For protection from White Pine Weevil, retain partial shade for individual stems. Remove only those trees which interfere with sunlight to the tops of the pines. Dense pockets of white pine may be completely released. Light crowned species such as birches, aspens and ashes should be favored over the coarser crowned species such as the oaks and maples.
- Minimum stocking for Spruce-Balsam Fir is 1000 seedlings or saplings per acre or 500 seedlings or saplings of other commercial species per acre. 4/ Begin thinning when trees are 5-10

feet in height. Favor spruce and other softwoods over balsam fir.

- On somewhat poorly drained soils, nearly pure stands of spruce and balsam fir may be grown with little hardwood control. On better-drained sites, hardwoods must be controlled if spruce and fir are favored.
- If Hardwoods comprise more than half of a stand, manage as a mixed stand.
- Weed, cut or kill:

  Trees which may damage desired stems.

  Trees of inferior species or inferior form, irrespective of species which are outgrowing desirable stems.

  Coarse stems of sprout origin which are outgrowing stems of seedling origin.

  Vines and overtopping shrubs which are competing with desirable trees.
- Don't overcut. Weed lightly and repeat the process more often.
- Do only what is necessary to bring the best trees through the next 5 years.
- Weed just enough to bring the upper crowns of valuable stems into full sunlight.
- Stands remaining after treatment should be dense to assure self-pruning of lower limbs, straightness of stem and protection against snow and ice damage.
- The following table relates the general soil moisture regime with the preferred, acceptable and weed species on a site:

  A. ***Dry Sites*** (usually sandy or shallow soils)

  Group 1 (Preferred species): White pine, Red pine.

  Group 2 (Acceptable species): Red and White Oak, Red Maple, White Birch, and White Spruce.

  Group 3 (Weed species or trees unsuitable for the site): Aspens, Gray Birch, Pin Cherry, Elm, Ash, Sugar Maple, Yellow Birch, Beech, Basswood, Hickories, Hophornbeam, and Willows.

  B. ***Moist Sites*** (usually loams or deep soils, well drained to moderately well-drained)

  Group 1 – Red Oak, Sugar Maple, Yellow and White Birch, Basswood, Ash, White Pine, Red Pine, Hemlock, White, Red and Norway Spruce.

  Group 2 – Red Maple, Beech.

  Group 3 – Aspens, Alders, Blue Beech, Elm, Pin Cherry, Hophornbeam, Mountain Maple, and Willows.

C. Wet or Poorly- Drained Sites

Not generally suited for commercial tree production

- The above groupings are a guide. It is not a complete listing. Management objectives may increase or decrease the relative desirability of a species. A state forester, consulting forester or industry forester may be consulted for recommendations concerning a particular site.
- Other general guidelines:
  - Species in Group 2 should be favored if no group 1
  - A straight stem in Group 2 would be favored over a poor quality stem in Group 1.
  - Group 3 may be used to assure a dense stand, but should be eliminated when they outgrow Group 1 or 2 trees.

RELEASING

- The purpose is to remove overtopping trees and provide improved growing conditions for desired species. See Weeding for a listing of preferred, acceptable and weed species.
- Used for Pole size timber, 4" to 8" in diameter.
- Stand is usually 15 to 30 years old.
- Thin stands according to the Stocking Guide (Table 1)
- Deviate from these guides when necessary to reduce damage to a stand from insects and disease, exposure (sun, wind, ice, snow), epicormic branching of hardwoods or to maximize cubic volume growth. 5/ 6/
- Physically remove, girdle or chemically kill in place. If chain saw is used, trees less than 6 inches diameter DBH will be completely severed and larger trees will be girdled with a double cut 2-4"

THINNING (COMMERCIAL AND PRE-COMMERCIAL)

- The purpose is to concentrate growth on individual trees intended for harvest in the future.
- Commercial thinning is used for Pulp and Sawlog timber, 8" in diameter and larger**.**
- Stand is usually 25 years and older.
- Pre-commercial thinnings are often necessary in stands where there is a very large number of trees (1000>per acre) of the same or similar species.
- Pre-commercial thinning is used in stands with trees that have an average diameter greater than four inches, but the trees harvested have no commercial value, either through sale or for use by the owner. 7/

TABLE 1

STOCKING GUIDES FOR EVEN-AGED STANDS

TREE TYPE	MEAN STAND DIAMETER	BASAL AREA	NUMBER OF TREES PER ACRE	SPACING 1/2 D + X	FT.
Northern	4	47	538	D+5	9
Hardwoods	6	59	304	D+6	12
	8	68	194	D+7	15
	10	73	135	D+8	18
	12	78	99	D+9	21
	14	88	83	D+9	23
	16	98	70	D+9	25
Paper Birch	4	59	681	D+4	8
	6	59	304	D+6	12
	8	59	170	D+8	16
	10	59	109	D+10	20
Upland Oaks	4	38	436	D+6	10
	6	52	258	D+7	13
	8	59	170	D+8	16
	10	66	121	D+9	19
	12	71	90	D+10	22
	14	74	70	D+11	25
	16	85	60	D+11	27
Eastern White	4	59	681	D+4	8

TREE TYPE	MEAN STAND DIAMETER	BASAL AREA	NUMBER OF TREES PER ACRE	SPACING 1/2D + X	FT
Pine,	6	86	436	D+4	10
Spruces and	8	105	304	D+4	12
Balsam Fir	10	121	222	D+4	14
	12	134	170	D+4	16
	14	143	135	D+4	18
	16	152	109	D+4	20

NOTE: D+X is a thinning guide used with the NRCS Woodland Information Stick which relates the size of a tree (i.e., diameter breast high, DBH) to the space available for it to grow. D is equal to a value in feet obtained by measuring DBH in even inches and expressing it in feet where 1" DBH = 1 foot stand, if DBH = 10", D = 10 feet. If D+4 spacing is desired, 10" DBH trees should be 14 feet apart (D=10) + (X=4)

REFERENCES

1/ Leak, William B., Dale S. Solomon, and Stanley M. Filip. 1969. *A Silvicultural Guide for Northern Hardwoods in the Northeast*. USDA Forest Service Research Paper NE-143.

2/ Safford, L.O. 1983. *Silvi-cultural Guide for Paper Birch in the Northeast* (revised). USDA Forest Service Research Paper NE-535.

3/ Lancaster, Kenneth F. and William B. Leak, 1978. *A Silvicultural Guide for White Pine in the Northeast*. USDA Forest Service General Technical Report NE-41.

4/ Frank, Robert M., and John C. Bjorkbom. 1973. *A Silvicultural Guide for Spruce-Fir in the Northeast*. USDA Forest Service General Technical Report NH-6

5/ Leak, William B. 1981. *Do Stocking Guides in the Eastern United States Related to Stand Growth*. Journal of Forestry Vol. 79, 661-664.

6/Maximum cubic volume growth may actually be obtained by using wider spacing for hardwoods and closer spacing for white pine.

7/ Blumenstock, Marvin. 1996. *Yankee Woodlot Bulletin #6 Working With It*. University of Maine Cooperative Extension Bulletin # 7079.

Maine Forest Service Forest Fact Sheet. 1986. *Weeding Young Forests*